

# From Framework to Forest Activities: A Comparative Analysis of Different Ownership Types in Two Adjacent Regions

Christoph Hartebrodt · Silke Bitz

Accepted: 28 June 2007 / Published online: 13 September 2007  
© Steve Harrison, John Herbohn 2007

**Abstract** The paper examines the interactions between the demands of society, the restrictions due to recreational and protective functions of forests and the intensity and kind of forest management in the various ownership classes in Switzerland (CH) and Baden–Württemberg (BW) in south–west Germany. A survey was carried out among owners of communal forests, private forest landholders owning more than 200 ha of forest land and small-scale forest enterprises with up to 200 ha of forest land. The survey adopted a two-dimensional approach, using regions and comparable ownership classes in order to identify basic differences and underlying key drivers. It became obvious that there are relevant distinctions between the two countries. The paper highlights the present use of forests, the restrictions perceived by their owners, and the underlying management strategies in terms of structure of the forests, tree species composition and thinning activities. In BW the financial function is the dominant motivation for the majority of the private owners. The communities emphasize both timber and non-timber functions of their forests. Except for the protection function (avalanches, rockslides) the utilisation and importance of the forest in CH is lower than in BW. Profitability of forests continues to be a key-driver of intensity of forest management activities, but there is less influence on the choice of basic silvicultural strategies. The results of this comparative survey are placed in the context of a forest policy framework and the medium-term financial situation in the two countries.

**Keywords** Two-dimensional analysis · Societal demands · Recreational and protective purposes · Planned behaviour · Behaviour control factors · Profitability as a key driver

---

C. Hartebrodt (✉) · S. Bitz  
Department of Forest Economics, Forest Research Institute Baden–Württemberg,  
Wonnhaldestrasse 4, 79100 Freiburg, Germany  
e-mail: Christoph.Hartebrodt@forst.bwl.de

## Introduction

Since World War II forest enterprises in Central Europe have made a far-reaching shift from profitable and mostly uninfluenced timber producers towards crisis-ridden owners of an almost public good, requested to accomplish a wide range of ecological and social demands (Schmithüsen et al. 1997; Oesten and Roeder 2002). According to the theory of planned behaviour, the behaviour of men is determined by attitude, subjective norms and behaviour control factors (Ajzen and Madden 1986; Ajzen 1991). There is extensive research on attitudes of forest owners and the influence of subjective norms (Bieling 2003, 2004; Hogl et al. 2005), but only limited knowledge on the influence of behavioural control factors (hereafter referred to as the 'framework'). Wherever this aspect was discussed, it became evident that framework factors can be identified, which influence owners' decisions (e.g. see Judmann 1998; Holmgren et al. 2004; Karppinen 2005; Harrison and Herbohn 2005). This paper aims to contribute to a deeper insight into these framework factors, focussing on the role of regional aspects, natural conditions, use and restriction of non-timber-functions, profitability and subsidy policy.

The framework factors are introduced in the following section. Due to the combination of regional and typological aspects the implicitly two-dimensional approach is then presented. Next, survey findings are reported, and are discussed with special regard to the most critical factors. Conclusions are then drawn with regard to methodological aspects and implications on forest management.

## Introduction of Relevant Framework Factors

### Role of Spatial Affiliation

Regional components are expected to take influence on key factors that affect the attitudes and behaviour of forest owners (e.g. Bieling 2003; Selter 2006). Thus a comparison between Baden-Württemberg (BW) and Switzerland (CH) as adjacent regions seems to be a promising approach to explain the behaviour of forest owners. Generally speaking, comparative studies are seen as a suitable vehicle to gain deeper insights into significance of regional aspects (e.g. Judmann 1998; Wiersum et al. 2005; Toivonen et al. 2005). The first central question (CQ1) that can be raised is whether regional aspects play a substantial role and if comparative approaches can be used to derive knowledge on that topic. The present analysis of distinctions due to the spatial affiliation is intensified, insofar three basic ownership classes in Switzerland (CH) and Baden-Württemberg (Germany, BW) respectively are involved, namely owners of small-scale forest estates (<200 ha, abbr. SSFE), greater private forests (>200 ha, abbr. LPFE) and community forests (<200 ha, abbr. COF).

### Natural Framework of Forestry

Forests play a substantial role in landscape management in both countries. Forest area comprises 39% of the total land area in BW and 30% in CH. The forests mainly

consist of coniferous forests (BW 65%, CH 71%), with identical estimated stand volumes ( $367 \text{ m}^3/\text{ha}$ ) which exceeds that of most countries and other regions in Europe (BMELV 2006). One relevant distinction is the level of the mean annual increment. In BW the forests achieve a very high level of  $13.7 \text{ m}^3/\text{ha}/\text{year}$ , whereas the Swiss forests grow by  $9.2 \text{ m}^3/\text{ha}/\text{year}$ , due to less favourable climatic and other natural conditions (LFI 1999; Kändler et al. 2005; BUWAL and WSL 2006). These observations lead to a further central question (CQ2): does the ‘law of locality’ in terms of natural, infrastructural and topographic conditions determine forestry in these regions, for instance in terms of accessibility and technical infrastructural constraints of forest management operations?

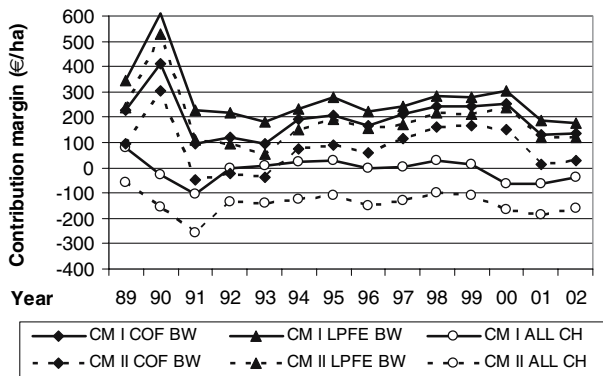
### Significance of the Various Non-timber Functions in Baden-Württemberg and Switzerland

Nowadays forests are in the public opinion not predominantly a place where timber is produced. In both countries, multifunctional forestry plays a prevalent role due to the high density of population (LFV 2004a; BUWAL and WSL 2006). This means that forests are used for financial, social (especially recreation and protection) and ecological purposes. However, the importance of individual functions differs. Due to topographic and sociogeographic reasons the protective functions plays a highly important role in CH. About 25% of the forest area provides direct protection for settlement areas and other infrastructural facilities against natural disasters, for example, avalanches, landslides, rockfalls and noises. This function is subordinate in BW, the proportion of forest area with designated protection function being less than 1%. Additionally, a small part of the forests with soil-protective functions (17% of forest area) is bound to this function. This may be contrasted with the relative importance of forest recreation. The Swiss forest report relates that there is no relevant public use in 83% of the forest area, and that only 5% of the area is heavily used (BUWAL and WSL 2006). In BW, 27% of the forest area is mapped as forests with notable recreational use. In both countries, there is a relevant utilisation of forest for supply of drinking water (LFV 2004a). The share of restricted forests is comparably low (about 2%) in both countries, but in BW a high share is part of landscape preservation areas (31%) and natural reserves (3%). A prevalent opinion is that ecological aspects and the recreation function are prominent in public opinion (e.g. Sanderson et al. 2000; Köechli 2006).

Related to this, third central research question (CQ3) to be discussed in the paper is, whether the increasing societal and ecological demands, and the restrictions due to these functions, are perceived as a major impediment in the view of the forest owners.

### Profitability of Forestry

For decades, forest enterprises in BW and CH have been suffering a slow decline in their profitability (Hartebrodt and Fillbrandt 2006; Burri 2004). Despite the fact that the felled volume per unit area has been rising, the cost-price squeeze has resulted in an increasing financial crisis, periodically aggravated by storm disasters (Hartebrodt



**Fig. 1** Time series of forestry contribution margins in BW and CH, 1989–2002

2004). A comparison between BW and CH shows that the financial pressure which burdens forest enterprises differs considerably. This may be examined in terms of *contribution margins*.<sup>1</sup> As illustrated in Fig. 1, the CM I in BW has been positive in all ownership types.<sup>2</sup> In BW, CM II was mostly positive in the past, except for a few years after severe storm disasters, whereas in CH this indicator has been negative since the late 1980s. Further, the CM I time series of CH since 1989 indicates that timber proceeds have been insufficient to cover the direct harvesting costs in half of the years.

From this a fourth central question (CQ4) can be derived: is the decreasing profitability a dominant factor that influences decisions of forest owners?

### Subsidy Policy as a Relevant Impact Factor

As a result of these distinctions in profitability, the amount of State-provided financial assistance varies between the two countries. Table 1 summarises the amounts of these subsidies in regular times and after storm disasters.

The subsidisation focuses on silvicultural and other forest activities (approximately 80% in BW and 50% in CH). Subsidisation of forest investments, especially for forest infrastructure, plays an important role and reaches a similar percentage in both areas of about 20%. Because protection against natural disasters plays such a major role in CH, 30% of the total amount of State-provided subsidies is spent for this purpose. Subsidy theory provides evidence that there is a notable trend that subsidy programs become almost irrevocable due to political reasons (Thormählen 1987). This can result in a decrease of self-reliance and financial interest (Kurki

<sup>1</sup> Contribution margin I (CM I) is defined as timber price less the direct harvesting costs, and is a strong indicator whether production of timber is economical rational. CM II is defined as CM I less the cost of forest production (including regeneration, precommercial thinning and pest management) and is suitable as an indicator for the feasibility of forest production in general.

<sup>2</sup> Data for both countries are only available for COF, LPFE and all ownership classes, including State owned forest enterprises (ALL).

**Table 1** Amount of State-provided forest subsidies in regular periods and after catastrophic events, CH and BW

Type of subsidy	CH	BW
Different types of subsidies for silvicultural operations and forest investments (BW 97–99, CH 99)	78.04 €/ha 17.55 €/m <sup>3</sup>	39.00 €/ha 4.48 €/m <sup>3</sup>
Share of subsidies on the total proceeds 1999 (BW 97–99, CH 99)	19%	6%
Storm related subsidies after the thunderstorm in 1999	33 €/m <sup>3</sup>	11 €/m <sup>3</sup>
Amount of state offered business loans after the thunderstorm in 1999	1 €/m <sup>3</sup>	0.3 €/m <sup>3</sup>

Source: LFV (2004b)

1991). The last central question (CQ5) to be analysed is: do State subsidy policies influence the behaviour and activity of forest owners.

## Research Method

A survey was carried out in various forest ownership classes in BW and CH. A detailed description of the research method can be found in Holthausen und Baur (2003, 2004) and Hartebrodt and Bitz (2007), and a brief account only is provided here. The method involved defining appropriate comparison pairs for both countries, as follows:

- (1) Communal forest enterprises in BW and in CH represent an important ownership type in both countries (BW 39% of the total forest area, CH 66%). The decision-making structures and a wide range of objectives with special regard to the local situation are almost identical. Therefore, there are no relevant constraints to use them as a comparison pair.
- (2) Small-scale forest enterprises are used as a second comparative pair. The size class distribution and average size have some differences, but with regard to the major objectives there is a wide overlap, because the main part of the enterprises are still operating as mixed agricultural and silvicultural enterprises, frequently combined with various forms of off-farm-employment.
- (3) The third comparative pair is more heterogeneous. The larger private forest enterprises in BW are privately owned and have an almost clearly defined financial interest. The 'Bürgergemeinden' in CH (BÜR CH) are collectively owned, but this particular Swiss type of local community has no right to impose taxes and hence has a strong incentive to avoid at least a negative operating result.

Table 2 depicts additional key characteristics of the respective comparative pairs and provides information on survey details, including population sizes and survey response rates.

The data have been collected as a part of a research project that focussed on the interdependencies between forestal framework, behavioural aspects and risk management strategies. The main topics of interest have been demographic aspects,

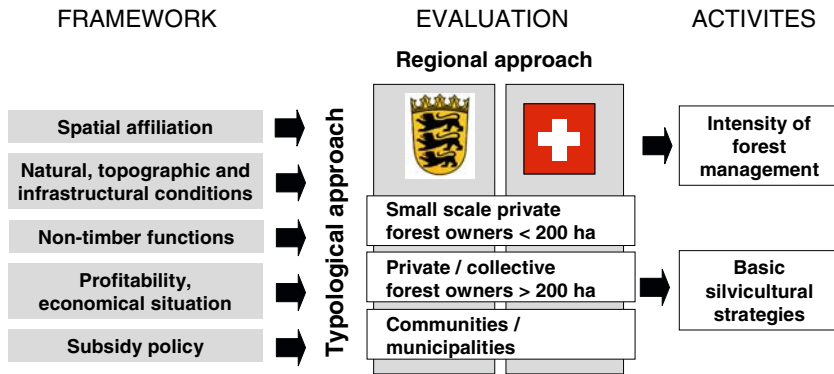
**Table 2** Characterisation of the population and formation of comparison pairs, BW and CH

Characteristics	Comparison pairs	
	Switzerland	Baden-Württemberg
Communal forest enterprises with fiscal sovereignty	Political communities	Political communities (>200 ha)
Number of respondents	79	262
Average forest size	278 ha	736 ha
Response rate	51%	44%
Small-scale forest enterprises	Private forest enterprises (all size classes)	Private forest enterprises (5–200 ha)
Number of respondents	300	156
Average forest size	3.8 ha	29.3 ha
Response rate	45%	75%
Financially oriented greater private or collectively owned forest enterprises	‘Bürgergemeinden’ collective forest property without tax sovereignty	Private forest enterprises (>200 ha)
Number of respondents	61	34
Average forest size	646 ha	1,893 ha
Response rate	51%	42%

an assessment of the topographical framework, basic silvicultural strategies, perception of storm risks and intensities and types of management strategies. In the financial dimension, respondents were asked for details of present forest profitability, and the importance in terms of the contribution to the total enterprise income and future financial expectations, especially with regard to the forecast operating result. The questionnaire was tested in a Swiss subpopulation and sent by mail to most ownership groups described above, but with owners of the smaller private forest enterprises in BW mostly interviewed personally but with some telephone interviews in cases when face to face interview were impractical.

The description of the framework is based on an extensive literature review, including the analysis of the results of nationwide forest inventories. Long-term accountancy networks in both countries provided detailed information about forest profitability in the various ownership classes. The perceptions, attitudes and activities of the owners were elicited using (mostly) four-point Likert scales, with subject-related response scales. Differences between the distributions of the responses within the respective comparison pairs were tested for significance using the Mann-Whitney *U*-test, which is suitable for small populations.

This comparison carried out in two adjacent regions in bordering countries offered the possibility to generate insights into the questions mentioned above. This method can be characterized as two-dimensional in terms of a regional approach, using BW and CH as two regions combined with an assessment in comparable ownership classes in both countries. The comparison between countries focuses on



**Fig. 2** Overview on the two dimensional evaluation design and main research focus

the impact of their political, natural and societal frameworks. The assessment across ownership types emphasizes the various roles forests play in different property types, as well as typical attitudes and perception of their owners. Figure 2 provides an overview on this two-dimensional approach.

## Survey Findings

Table 3 provides an overview on the respective significance level between the corresponding ownership classes in BW and CH and highlights the relevant distinctions between these adjacent regions. Where no other information is provided, 4-point Likert scales are used; scores in brackets have been weighted by their frequencies for the calculation means. In general it can be concluded that the statistical significance of differences between the corresponding ownership classes in BW and CH was high, especially with regard to the owners of smaller private and communal estates. The discussion of these distinctions is provided subsequently in the context of the description of the framework factors discussed below.

## Natural and Technical Constraints

The perception of the owners concerning topographical and infrastructural constraints reveals little variation, and with regard to the communities, some unexpected results. As indicated in Table 4, 44–54% of the respondents characterised the conditions as difficult or predominantly difficult in terms of technical constraints for forest activities. The communities (COF BW, 59%) and especially the Bürgergemeinden (BÜR CH, 65%) provided a more negative evaluation (mean 2.1). The perception of the conditions was, as expected, worse in CH but the difference of mean is limited to 0.2 on the four-point Likert-scale (Table 4).

**Table 3** Statistical significance of the frequency distributions of corresponding ownership classes in BW and CH

Research finding	SSFE BW- SSFE CH	COF BW- COF CH	LPFE BW- BÜR CH
Natural framework			
Topographic and infrastructural situation/ constraints		*	
Use of different forest functions			
Recreation	**	**	
Protection	*	*	*
Financial weight	**	**	**
Restrictions on forest activities due to:			
Recreation	**	**	
Protection function			
Nature protection		*	*
Management and operating result			
Harvesting intensity	**	**	**
Share of mixed stands	*	**	
Regeneration of broadleaf stands		**	
Operating result	**	**	**

\* Significant at the 5% level; \*\* Significant at the 1% level

**Table 4** Appraisal of the topographic and infrastructural conditions by the owners of forest enterprises

Topographical and infrastructural conditions	Proportion of answers in each ownership class (%)							
	SSFE BW	SSFE CH	COF BW	COF CH	LPFE BW	BÜR CH	ALL BW	ALL CH
Simple (4)	15	12	3	11	9	8	9	10
Predominantly simple (3)	39	32	37	41	38	25	38	33
Predominantly difficult (2)	37	33	41	28	44	35	41	32
Difficult (1)	9	19	18	16	9	30	12	22
Mean score	2.6	2.3	2.3	2.4	2.5	2.1	2.4	2.2

## Relative Importance of Alternative Forest Functions

The appraisal of the forest owners concerning the recreation functions is similar to the results of the national forest inventories (LFI 1999; LFV 2004a). The use of the forests for recreational purposes in BW is considerably more intensive, except for the LPFE BW and BÜR CH. A comparison between the ownership classes reveals the outstanding role of the recreation function in communal forests (COF BW, COF CH, BÜR CH). There is less recreation use in the smaller forest properties (Table 5).

The responses reveal greater use of the protection function in CH (Table 6). The proportion of enterprises in CH which nominate a high importance of this function is at least twice that of BW in COF CH, and reaches an 11-fold rate in BÜR CH.



**Table 5** Intensity of forest use for recreational purposes

Use for recreational purposes	Proportion of answers in each ownership class (%)							
	SSFE BW	SSFE CH	COF BW	COF CH	LPFE BW	BÜR CH	ALL BW	ALL CH
High (4)	16	10	45	32	25	43	29	28
Medium (3)	28	17	46	33	44	40	39	30
Low (2)	35	31	9	28	28	15	24	25
Insignificant (1)	20	40	0	5	0	2	7	16
Mean score	2.4	1.9	3.4	2.9	2.9	3.3	2.9	2.7

**Table 6** Intensity of use of the protection function

Use for protective purposes	Proportion of answers in each ownership class (%)							
	SSFE BW	SSFE CH	COF BW	COF CH	LPFE BW	BÜR CH	ALL BW	ALL CH
High (4)	2	3	2	17	3	33	2	18
Medium (3)	2	7	15	11	6	13	8	10
Low (2)	7	15	36	33	28	13	24	20
Insignificant (1)	90	75	47	37	63	40	66	51
Mean score	1.2	1.4	1.7	2.0	1.5	2.4	1.5	1.9

Responses of the owners about perceived financial importance reveal that forests in BW still contribute to the owners income (mean importance score 3.2). Across all groups, not less than half of the interviewees perceived an important or moderately important contribution in BW, and for the owners of larger private estates (LPFE BW) it is the predominant function with about 80% stressing the financial importance. In CH the importance of this function perceived is much lower, particularly for the owners of smaller private forest enterprises and the communities. Only the so-called Bürgergemeinden, which are not allowed to impose taxes, state that the financial sphere is important (32%) or moderately important (30%) (Table 7). In general it can be stated that the financial importance of forests in CH is much lower (mean 2.3) than in BW.

### Perception of Constraints Due to Social and Ecological Functions

The owners of the smaller private estates mostly perceived no relevant restrictions due to recreational use, in contrast with the communal forests in both countries. About one third of the larger private forest estates reported medium severity of restrictions, but the share of large enterprises suffering high restrictions is small and comparable to that of the smaller private properties (Table 8).

With regard to the protection function it can be stated that the distinctions between the ownership types are more relevant compared to the limited differences between the countries. The communities and larger private properties perceived

**Table 7** Perceived financial importance of forest income

Perceived financial importance	Proportion of answers in each ownership class (%)							
	SSFE BW	SSFE CH	COF BW	COF CH	LPFE BW	BÜR CH	ALL BW	ALL CH
Important (4)	36	7	25	11	79	32	47	17
Moderately important (3)	41	14	30	13	15	30	29	19
Little importance (2)	21	44	38	54	6	23	22	40
Unimportant (1)	3	35	7	21	0	10	3	22
Mean score	3.1	1.9	2.7	2.1	3.7	2.7	3.2	2.3

**Table 8** Restrictions on forest management perceived due to recreational use

Restrictions perceived due to recreational use	Proportion of answers in each ownership class (%)							
	SSFE BW	SSFE CH	COF BW	COF CH	LPFE BW	BÜR CH	ALL BW	ALL CH
High (4)	3	2	14	9	3	5	7	5
Medium (3)	15	5	30	21	30	24	25	17
Low (2)	41	22	46	25	58	41	48	29
Insignificant (1)	41	70	10	45	6	29	19	48
Mean score	1.8	1.4	2.5	1.9	2.2	2.1	2.2	1.8

**Table 9** Restrictions perceived due to the protection function

Restrictions due to the protection function	Proportion of answers in each ownership class (%)							
	SSFE BW	SSFE CH	COF BW	COF CH	LPFE BW	BÜR CH	ALL BW	ALL CH
High (4)	2	1	3	11	3	14	3	8
Medium (3)	2	2	16	12	22	12	13	9
Low (2)	15	11	39	25	19	33	24	23
Insignificant (1)	81	85	42	51	56	41	60	59
Mean score	1.2	1.2	1.8	1.8	1.7	2.0	1.6	1.6

medium or high restrictions, but to about one fourth it is not perceived as a highly relevant restriction in all ownership types (Table 9).

About one third of the communities and more than 40% of the LPFE BW highlighted high or medium charges and restrictions concerning the requirements for nature conservation. The level is in CH much lower. In both countries the smaller private forest enterprises are more or less uninfluenced (Table 10).

**Table 10** Restrictions perceived due to nature conservation<sup>a</sup>

Restrictions perceived due to nature conservation	Proportion of answers in each ownership class (%)							
	SSFE BW	SSFE CH	COF BW	COF CH	LPFE BW	BÜR CH	ALL BW	ALL CH
High (4)	1	3	7	9	12	5	7	6
Medium (3)	5	5	26	14	32	16	21	12
Low (2)	28	13	47	42	47	47	41	34
Insignificant (1)	66	77	20	33	9	33	31	48
Mean score	1.4	1.3	2.2	2.0	2.5	1.9	2.0	1.7

<sup>a</sup> Restrictions due to nature protection include restrictions in nature reserves, landscape conservation areas and EU-framework directive flora- and fauna-habitats

### Forest Activities and Related Financial Expectations

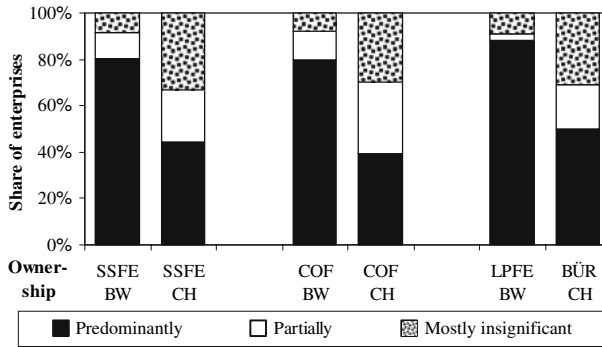
In BW there is wide consensus concerning continuous thinning and harvesting activities. More than 80% of the interviewees indicated that they maintain a continuous forest management. The level in CH is much lower, less than half the enterprises stating that there is a continuous management of the stands. The proportion of respondents stating that the harvesting activities are at least partially continuous reaches only approximately two thirds in CH compared with BW (Fig. 3). It is notable that all statistical differences are significant at the 1% level.

The relevance of mixed stands, which are characterised as stands with at least two different species, shows stronger distinctions between the individual ownership types (Fig. 4). There is no general pattern in the individual countries. The share of private enterprises (SSFE, LPFE BW and BÜR CH) with predominantly mixed stands is about 10% higher in CH than in BW. However, about 60% of the communities in BW have predominantly mixed stands, compared with less than 40% in Switzerland.<sup>3</sup>

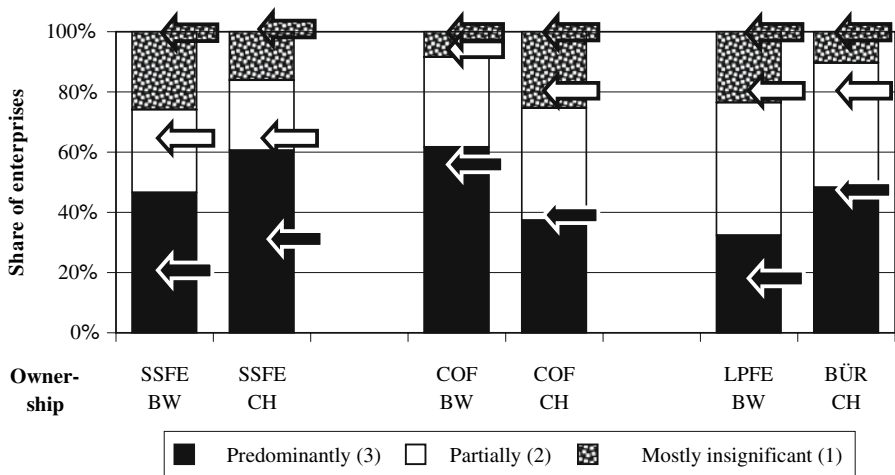
It can be shown that the share of broadleaves is not only a result of forest history because the current relevance of mixed stands (bar-chart) corresponds with the present regeneration activities in terms of the relevance of broadleaf regeneration (arrowheads). There is relatively higher representation of enterprises which presently emphasize the regeneration of broadleaf-dominated stands in the private forests of CH. The proportion of broadleaf regeneration is higher in the Baden-Württembergian communal forests.

Appraisal of the expected operating results (within a 5-year period after the survey) reveals a wide difference between countries and ownership types. In general, the forest owners in BW make more positive evaluations, with two thirds of the private owners (SSFE BW and LPFE BW) expecting a positive operating result in the future (Fig. 5). The communities in BW expect poorer operating results but

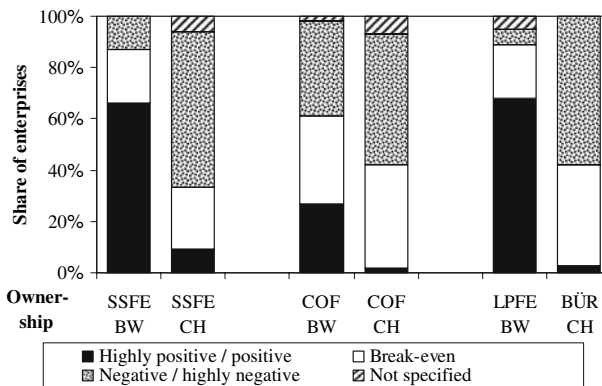
<sup>3</sup> The difference between SSFE BW and SSFE CH is significant at the 5% level, the difference between COF BW and COF CH is significant at the 1% level.



**Fig. 3** Percentage bar chart of share of enterprises with continuous timber harvesting



**Fig. 4** Relevance of mixed stands and share of regeneration with broadleaf species



**Fig. 5** Percentage bar chart of expected operating results in the various ownership classes

nevertheless one quarter expects a positive outcome and almost two thirds at least a break-even result. In CH not more than 10% of the enterprises expect positive financial results, and about 40% expect a break-even result, with little variations between the ownership classes. All differences between the comparison pairs are statistically significant at the 1% level.

## Discussion and Summary of the Critical Factors

As the study aims to contribute insights into what aspects of the framework are of overriding relevance, the individual factors have to be discussed. Table 11 provides both an overview on the appraisal of the relevance of the various factors in the individual ownership class, and the distinctions between ownership classes and between the two countries. Only a joint assessment of distinctions and relevance leads to an identification of key factors and allows the response to the central questions (CQ1-5).

### Significance of the Spatial Affiliation

The cross tabulation from framework factors and ownership classes (Table 3) leads to a statistically significant distinction between BW and CH in 66% (thereof 63% highly statistically significant) and at least 50% of the factors discussed here. Three items representing intensity and type of forest management (Harvesting intensity, Share of mixed stands, Regeneration broadleaf stands), as well two thirds of the comparisons, exhibit a statistically significant difference. The thesis that appraisals of forestry and the attitudes of forest owners in CH and BW differ strongly has to be supported; prior research findings of other studies (Bieling 2003, 2004; Hogl et al. 2005; Selter 2006) are confirmed, and CQ1 has to be answered positively. Spatial affiliation as a meta-indicator for a wide set of framework factors is crucial, for both perception of factors and related forest activities.

### Topographical, Infrastructural and Silvicultural Framework

The quintessence answering CQ2 is that the framework set by topography, infrastructure and silvicultural conditions provides only a weak partial explanation for differences concerning attitudes and behaviour of forest enterprises.

Enterprise size differs to a greater extent but considering average size it can be stated that this difference is only relevant in SSFE (average size 4 ha in CH and 30 ha in BW). This is in agreement with the recent finding of Selter (2006) that size class has a relatively small impact on attitudes, behaviour and financial performance.

At first sight the influence of the growth rate of stands on the operating result is notable (Hartebrodt et al. 2005) and results in a relevant disadvantage for Swiss forestry. But only 70% of the annual increment is harvested in CH. Obviously the potential growth rate does not presently constrain more intensive use of forests.

It is common sense that the topographical and infrastructural framework of the individual enterprises has a major impact on the financial performance of the

**Table 11** Comparative overview on relevance perceived of individual factors, management intensity and silvicultural strategies and differences between and ownership classes in the two countries

	SSFE		LPFE/BÜR						COF		ALL					
Topographic and infrastructural constraints	BW	+								-						-
	CH	-								-						-
Use and Restrictions		UR	RR	UP	RP	RN	UR	RR	UP	RP	RN	UR	RR	UP	RP	RN
	BW	-	-	-	-	-	+	-	-	-	-	+	-	-	-	-
Financial situation and expectation	CH	-	-	-	-	-	+	-	-	-	-	+	-	-	-	-
		EW	EX				EW	EX				EW	EX			
Intensity of forest management	BW	+	↑				++	↑				+				+
	CH	-	=				+	=				-	↓			=
		ST	IH	CH			ST	IH	CH			ST	IH	CH		
	BW	↑	+	↑			↑	++	↑			↑	++	↑		
Silvicultural strategies	CH	=	+	=			=	+	=			=	+	=		
		BL	MS	TB	OL		BL	MS	TB	OL		BL	MS	TB	OL	
	BW	=	=	=			=	=	=			↑	↑	=	=	=
	CH	=	=	=			=	=	=			=	=	=	=	=

Abbreviations: UR = Use for recreation, RR = Restrictions due to recreation, UP = Use for protection, RP = Restriction due to protection, RN = Restriction due to nature conservation; EW = Financial weight, EX = Financial expectations, ST = significance of timber products, IH = Intensity of harvesting, CH = Commercial harvest; BL = Broadleaf Regeneration, MS = Mixed Stands, TB = from below; OL = Importance of one layered stands

Evaluations of relevance perceived based on a 4-point Likert-scale: ++ high, + medium, - low, -- insignificant

Evaluations of relevance perceived based on a 3-point Likert-scale: ↑ predominantly/positive, = partially significant/break-even, ↓ insignificant/negative

enterprise, but neither the difference between the comparison pairs nor the low relevance perceived by the forest owners give hints that these factors have a strong explanatory power in this two-dimensional, comparative analysis. This is consistent with the findings of Bieling (2003) that owners are not perceived concrete problems with the condition of their forests.

### Perceived Use of Non-timber Functions and their Related Restrictions

The relevant difference between the communal forests and private forest owners indicates that the perception of owners of public forests is influenced by the higher use for recreational purposes.

The difference of mean between the perception of the intensity of use (Table 5), and restrictions due to recreational functions of forests (Table 8), can be taken as a feasible indicator for a distinct perception of use and restrictions perceived. Despite the fact that the owners perceive a heavy use of the recreation function of forests (mean<sup>4</sup> ALL BW 2.9; ALL CH 2.7), the results provide evidence that the restrictions perceived are much lower (mean ALL BW 2.2, ALL CH 1.8) compared to the use of forests. This difference of 0.9 in CH and 0.7 in BW, is very high in relation to the four-point Likert scale range. The restrictions in SSFE are negligible; only the communities in BW regard restrictions as relevant. On average recreational purposes constrain, in the perception of the owners, forest management activities more in BW. This corresponds to the results of the nationwide forest inventories in the individual regions (LFI 1999; LFV 2004a).

As expected, the use of the protection function is of greater concern in CH (average score 1.93) than in BW (1.46), but is less important than the recreation function. Forest use for the protection function is low in BW and in SSFE in CH. Owners of COF CH and especially BÜR CH note a heavier use of this function. The respondents ranking of the restrictions due to this forest use is equally low in both countries (BW 1.58, CH 1.64), and in SSFE this restriction is not relevant. Restriction due to nature conservation is more highly ranked in BW (2.03) than in CH (1.73). Again, there is low impact on SSFE in both countries. The impact on communities and larger private estates is higher. The LPFE respondents in BW highlighted constraints due to nature conservation.

With the regard to the comparison between adjacent regions, it is an unexpected finding that restrictions are rated as being more relevant in BW. Furthermore, it becomes obvious that there is a different pattern with regard to the individual forest function in the different regions. Highly similar ratings of the various types of restrictions (recreation, nature conservation, protection) have been found for CH (of 1.78, 1.73 and 1.64 respectively), whereas forest owners in BW emphasized the restrictions due to recreation and nature conservation but classified the protection function as relatively unimportant (with respective ratings of 2.17, 2.03 and 1.58).

In general the role of these kinds of societal demands is widely discussed within the representatives of private and communal forest owners. Nevertheless, the survey findings indicate that they are mostly regarded as unimportant by the owners of smaller

<sup>4</sup> 4 = high, 1 = insignificant.

private forests. For forests located close to settlement areas, there is relevant use of recreational purposes and notable but not far-reaching restrictions. With regard to the limited restrictions, in the opinion of the owners (for which there are few statistically significant differences), the societal use and the restrictions due to the various forestry functions do not adequately explain the relevant differences with regard to intensity of forestry between the two regions. Research findings of Judmann (1998)—who provided evidence that the role of the protection and recreational function of forest is accepted by SSFE—are supported. As Judmann (1998) also reported comparable results gathered in Pennsylvania, this might be a widespread pattern.

### Financial Situation and Expectations

The above results indicate a stronger relationship between financial performance and ownership class than to the region. With regard to monetary factors, it becomes obvious that the differences are mainly related to the spatial affiliation. The time series of CM I and CM II illustrate that there has been a stable difference for more than a decade. Forestry in BW is still profitable and the cost of all forest operations can be covered by the timber proceeds. A detailed analysis of the individual ownership classes in BW leads to the conclusion that financial performance in COF BW is worse than that of the LPFE BW and SSFE BW. However, the CM II in COF BW was negative for three out of 14 years only. Despite the fact that the COF in BW have achieved the poorest financial results it is, in contrast, apparent that in CH even direct harvesting costs (CM I) were not covered in years after storm events (in years 1990–1992 and 2000–2004, as illustrated in Fig. 2). The situation in CH is therefore more crucial compared to the worst situation in BW.

This leads directly to the forecast of the operating results. As mentioned above, the majority of private forest owners in BW expect positive financial results in the future.<sup>5</sup> The influence of the poor operating results in the recent years is visible in the COF BW. Despite the fact that the operating results are much better than in CH, the difference between the private forest owners in BW shows that the worse financial situation in communal forests sharply decreases the expectations for these forests. After more than a decade of negative results in CH a high proportion of the enterprises have negative expectations. The belief in a profitable forest enterprise is widely lost.

The interpretation of the financial weight of forestry on overall enterprise income underlines the findings and confirms prior results. Bieling (2003) stated that 43% of the SSFE are classified as financially interested (most important class) and that cost coverage is an important factor in the framework. Within the group of SSFE, the enterprise size must be taken into account, but the tremendous difference cannot be explained only by enterprise size. The observed financial results in the communities and larger private estates reflect this finding. The share of forest income in most of the communities does not exceed 1–2% of the total communal budget in both

<sup>5</sup> The respondents were asked to evaluate the financial (operating) results on a 3-point Likert scale. Scores of 3.0–2.5 represents positive or highly positive financial outcomes, 2.49–1.5 breakeven, and 1.49–1.0 negative or highly negative outcomes. The results obtained in the different ownership classes are: SSFE BW 2.53, SSFE CH, 1.35; COF BW 1.86, COF CH 1.37, LPFE BW 2.52; BUR 1.45.



countries. Despite the fact that the ‘true’ financial importance (in terms of percentage of the entire budget) is equally low in CH and BW, the appraisal of the Swiss communities underlines the tremendous decrease in belief of a financially viable forest sector after 15 years of negative operating results in CH, compared with the situation in BW where the financial dimension plays still a role in communal forest enterprises. Zimmermann et al. (1996) noted that public interest in forest increases in case of budget deficits in CH.

The financial dimension influences the perceptions and behaviour to a greater extent than the other framework factors. In view of the intensity of the forest management there is a considerable overlap between the appraisal of the whole financial sphere (profitability, importance and expectation) and the intensity of forest management, in terms of frequency of thinning operations, commercial harvesting and share of stands treated regularly. This corresponds with findings of Hogl et al. (2005) of higher harvesting activity within the group of farm forest owners, which is primarily driven by financial considerations. Bieling (2003) also observed the importance of profitability for farmer owners with larger forest estates. Karppinen (2005) adopted the theory of planned behaviour and showed that expensiveness of planting trees is a notable behavioural control factor. Generally speaking it can be concluded that the adoption of continuous forest management is more or less strongly related to the possibility of meeting financial success with these activities.

With regard to the wide consensus on that topic, the CQ4 must be answered positively. A decreasing profitability is a crucial factor with regard to the maintenance of forestry.

#### Interdependency Between Subsidy Policy and Intensity and Kind of Forest Management

Even a higher subsidisation in CH has not prevented this decline of the timber function of the forests in CH. A continued low profitability is therefore likely to endanger all forest functions that are closely related to continued tending and harvesting activities. Despite the fact that the age or obsolescence of the forests is considered a relevant risk for the protective function in CH and therefore more crucial in CH, the rational awareness of the need of forest activities cannot bridge the gap resulting from permanent deficits. This supports the argument of Bieling (2003) that subsidisation offers only weak incentives to intensify forest activities. CQ5 has to be answered as follows: The direct effects of subsidisation of individual measures are not strong enough to promote these forest activities in the case of negative financial performance. Only if subsidisation is perceived as a component that helps the owners to achieve a reasonable profit will it contribute notably to the continuance or intensification of forest management.

#### Implications on Forest Management and Concluding Remarks

From the methodological point of view it can be said that the behavioural control factors, which are a relevant part of the theory of planned behaviour, play a

substantial role in forest management. The applicability of this theory can be confirmed in terms of the significance of behavioural control factors. Despite the fact that attitudes and subjective norms are considered as prevalent (Judmann 1998; Bieling 2003; Karppinen 2005) it must be stated that it is important to take the framework factors as well into account. The present results provide evidence that behavioural studies without inclusion of an assessment of the financial framework are in danger of being too fragmentary.

In contrast to the sharp distinctions between regions concerning the intensity of forest management, the implications for the basic silvicultural strategies are less clear. Distinctions are apparent between property types, but it is not possible to derive a common pattern related to the location. The survey included several questions concerning basic silvicultural strategies (e.g. type of thinning, vertical structure of forests). Some partially distinctive differences were observed between the comparison pairs. It was not possible however to identify a uniform pattern, which can be used to derive relevant differences in silviculture or offers hints for relevant differences. A comparison between the present tree species composition and the present regeneration activities can be interpreted as an indication that silviculture follows traditional patterns. A conclusion is that the kind of forest management has not changed until now but the decreasing activity will indirectly come to influence the structure and vitality of forests.

It can be concluded that forest policy should emphasize measures for improving financial viability, such as developing new timber markets and improving the forest structures in order to reduce the operating cost, more than the subsidisation of individual silvicultural measures.

The societal demand of forest functions and even a predictable threat due to the protective function are presently not strong enough to preserve a constant level of forest management. The halo-effect of the former financial function is still notable, even in communal forests, which are dedicated to provide a wider range of forest functions. Decision-making in forests is not monocausal; there are important interferences between the single components. Nevertheless, the findings gathered from the two-dimensional comparison between BW and CH provide evidence that the role of the financial success on the forest management is still dominant. At heart, most forest owners are still timber producers.

**Acknowledgements** We thank the Swiss Federal Institute for Forest, Snow and Landscape Research for the right of use of the Swiss dataset on the attitude and behaviour of Swiss forest enterprises. The ‘Waldwirtschaft Schweiz’ made a substantial contribution concerning data of the financial situation in Switzerland. Special thanks to Nils Holthausen, Roland Burri and Priska Baur for the valuable contributions concerning Swiss data, and information on the specific forest conditions in Switzerland.

## References

- Ajzen I (1991) The theory of planned behavior. *Organ Behav Hum Decis Process* 50(2):179–211
- Ajzen I, Madden T (1986) Prediction of goal-directed behavior—attitudes, intentions, and perceived behavior control. *J Exp Soc Psychol* 22(4):453–474
- Bieling C (2003) Naturnahe Waldbewirtschaftung durch private Waldeigentümer—Akzeptanz und Umsetzung naturnaher Bewirtschaftungsformen im Kleinprivatwald des Südschwarzwaldes. *Freiburger Schriften zur Forst- und Umweltpolitik* 2:159 p. zzgl. Anhang

- Bieling C (2004) Non-industrial private forest owners: possibilities for increasing adoption of close-to-nature forest management. *Eur J For Res* 2004(123):293–303
- BMELV (Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz) (2006) BWI<sup>2</sup>—Das wichtigste in Kürze—Vorräte. [http://www.bundeswaldinventur.de/enid/3bf27804ee75294f18b00d285e90c3f2\\_4e0ad6305f7472636964092d09313037/4m.html](http://www.bundeswaldinventur.de/enid/3bf27804ee75294f18b00d285e90c3f2_4e0ad6305f7472636964092d09313037/4m.html), accessed 25 July 2006
- Burri R (2004) Waldwirtschaft im 'Jahrhundertsommer' 2003—BAR Zahlen 2003. *Wald und Holz*, 04(9):34–36
- BUWAL (Bundesamt für Wald), WSL (Eidgenössische Anstalt für Wald, Schnee und Landschaft) (eds) (2006) Waldbericht 2005—Zahlen und Fakten zum Zustand des schweizer Waldes. Eigenverlag BUWAL, Bern
- Harrison S, Herbohn J (2005) Relationship between farm size and reforestation activity: evidence from Queensland studies. *Small-scale For Econ Manage Policy* 4(4):471–484
- Hartebradt C (2004) The impact of storm damage on small-scale forest enterprises in the southwest of Germany. *Small-scale For Econ Manage Policy* 3(2):203–222
- Hartebradt C, Bitz S (2007) Einstellung baden-württembergischer Waldbesitzer zu Sturmrisiko und Versicherungslösungen gegen Sturm. Schriftenreihe Freiburger Forstliche Forschung. Wald—Besitz—Ökonomie 2007 (in press)
- Hartebradt C, Fillbrandt T (2006) Wirtschaftliche Risiken der Baumartenverschiebung—Forstökonomische Fakten im Kontext der Ergebnisse der Bundeswaldinventur II. *Holz-Zentralblatt* 6(3):88–89
- Hartebradt C, Fillbrandt T, Brandl H (2005) Community forests in Baden-Württemberg (Germany): a case study for successful public–public-partnership. *Small-scale For Econ Manage Policy* 4(3):229–250
- Hogl K, Pregering M, Weiss G (2005) What is new about new forest owners? A typology of private forest ownership in Austria. *Small-scale For Econ Manage Policy* 4(3):325–342
- Holmgren E, Lidestav G, Kempe G (2004) Forest condition and management in Swedish commons. *Small-scale For Econ Manage Policy* 3(3):453–468
- Holthausen N, Baur P (2003) Naturrisiken im Schweizer Wald: Bewältigung durch eine Solidargemeinschaft? Eidg. Forschungsanstalt WSL, Abteilung Ökonomie, <http://www.wsl.ch/lm/publications/books>, Birmensdorf, accessed 24 Sept. 2005
- Holthausen N, Baur P (2004) Zum Interesse an einer Versicherung von Sturmschäden im Schweizer Wald. *Schweizer Zeitschrift für Forstwesen* 155(10):426–436
- Judmann FKL (1998) Die Einstellung von Kleinprivatwaldeigentümern zu Ihrem Wald—Eine vergleichende Studie zwischen Baden-Württemberg und dem US-Bundesstaat Pennsylvania. Dissertation an der Forstwissenschaftlichen Fakultät der Universität Freiburg, Eigenverlag: 243 S. zzgl. Anhang
- Kändler G, Bösch B, Schmidt M (2005) Wesentliche Ergebnisse der zweiten Bundeswaldinventur in Baden-Württemberg—Rückblick und Ausblick. *Forst und Holz* 60(2):45–49
- Karppinen H (2005) Forest owners' choice of reforestation method: an application of the theory of planned behaviour. *For Policy Econ* 7:393–409
- Koechli DA (2006) Gewichtung der Ansprüche der Gesellschaft an den Wald. *Schweizerische Zeitschrift für Forstwesen* 157(1):31–36
- Kurki M (1991) Untersuchungen zur Förderung der Forstwirtschaft in Baden-Württemberg. Dissertation—Unter Berücksichtigung der Subventionstheorie und der Evaluierungsforschung. Mitteilungen der Forstlichen Versuchs- und Forschungsanstalt Baden-Württemberg, 155, Eigenverlag FVA
- LFI (Landesforstinventar Schweiz) (1999) Internet-Ergebnisdarstellung des Landesforstinventars: <http://www.lfi.ch/resultate/schweiz.php>, accessed 10 March 2006
- LFV (Landesforstverwaltung Baden-Württemberg) (2004a) Sturm 'Lothar'—Bewältigung der Sturmschäden in den Wäldern Baden-Württembergs, Dokumentation, Analysen, Konsequenzen. Schriftenreihe der Landesforstverwaltung (83), Eigenverlag LFV Baden-Württemberg, Stuttgart
- LFV (Landesforstverwaltung Baden-Württemberg) (2004b) Forststatistisches Jahrbuch der Landesforstverwaltung BW. Eigenverlag LFV Baden-Württemberg, Stuttgart
- Oesten G, Roeder A (2002) Management von Forstbetrieben—Band I, Grundlagen, Betriebspolitik. Verlag Dr. Kessel, Remagen-Oberwinter
- Sanderson L, Beesley K, Colborne R (2000) Public perceptions and attitudes towards sustainable forest management: central nova scotia, 2000. Research Report Nova Forest Alliance—Canada Model Forest Program
- Schmithüsen F, Kazemi Y, Seeland K (1997) Perception and attitudes of the population towards forests and their social benefits—social origins and research topics of studies conducted in Germany, Austria and Switzerland between 1960 and 1995. IUFRO Occasional Paper No. 7, IUFRO, Vienna

- Selter A (2006) Der Einsatz multivariater statistischer Methoden zur Erarbeitung einer Betriebstypologie für den bäuerlichen Privatwald. Inaugural-Dissertation, Albert-Ludwigs Universität Freiburg
- Thormählen T (1987) Wie weit ist der Subventionsabbau vorangekommen? *Wirtschaftsdienst* 67(19):554–569
- Toivonen R, Järvinen E, Lindros K, Rämö AK, Ripatti P (2005) The challenge of information service development for private forest owners: the Estonia and Finland case. *Small-scale For Econ Manage Policy* 4(4):451–470
- Wiersum K-F, Elands BHM, Hoogstra MA (2005) Small-scale forest ownership across Europe: characteristics and future potential. *Small-scale For Econ Manage Policy* 4(4):1–20
- Zimmermann W, Wild S, Schmithüsen F (1996) Einstellung der Bergbevölkerung zu Wald, Forstwirtschaft und Forstpolitik. *Schweizer Zeitschrift für Forstwesen* 147:727–747